NON-PUBLIC?: N
ACCESSION #: 9111250168
LICENSEE EVENT REPORT (LER)

FACILITY NAME: SAN ONOFRE NUCLEAR GENERATING STATION, PAGE: 1 OF 6
UNIT 1

DOCKET NUMBER: 05000206

TITLE: UNIT 1 AUTOMATIC REACTOR TRIP UPON TRANSFER OF VITAL BUS #1 WITH
PRE-EXISTING FAILURE OF HIGH STARTUP RATE BLOCK RELAY
EVENT DATE: 10/17/91 LER #: 91-017-00 REPORT DATE: 11/18/91

OTHER FACILITIES INVOLVED: NONE DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 091

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: R.W. Krieger, Station Manager TELEPHONE: (714) 368-6255

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JC COMPONENT: RLY MANUFACTURER: W120
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At 1314 on 10/17/91, during the performance of corrective maintenance on an alarm module powered from Vital Bus No. 1 (VB1), and with a pre-existing failure of the high startup rate (SUR) block relay (AP4D), Unit 1 automatically tripped from 91% power on a spurious high SUR signal. The spurious SUR signal was generated when a momentary power interruption to VB1 occurred during an automatic transfer of VB1 to its alternate power source, which was initiated due to a momentary ground fault on the bus. As a taped alarm module power lead was being routed through a grooming hole in the module chassis, the lead arced apparently through the tape to the module chassis, causing the ground. The reactor protection system (RPS) and automatic control systems functioned as designed, and the plant was stabilized in Mode 3 at 1342. An auxiliary

feedwater (AFW) actuation occurred due to the expected decrease in steam generator levels following the trip. All AFW components responded in accordance with design, and the AFW actuation was reset at 1401.

Laboratory analysis of the taped lead revealed that the insulating capability of the tape had apparently been degraded during handling. This is postulated to have occurred when the taped lead contacted a sharp edge of the grooming hole on the alarm module chassis when the lead was inserted through the hole.

The methodology used to route insulated live leads will be reviewed. Any methodology enhancements identified by this review will be implemented as appropriate.

There is no safety significance to this event since all RPS and AFW components actuated in accordance with design.

END OF ABSTRACT

Plant: San Onofre Nuclear Generating Station
Unit: One
Reactor Vendor: Westinghouse
Event Date: 10-17-91
Time: 1314

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, Power Operation

B. BACKGROUND INFORMATION:

One of the reactor protection system (RPS) JC! trip signals is high startup rate (SUR). De-energization of either of two high SUR bistables causes de-energization of the related undervoltage scram (UVS) relay 27!, which trips the reactor. When greater than 10% power (nominal), the impact of either high SUR bistable on the UVS relay is bypassed by energization of the high SUR block (AP4B and AP4D) relays RLY!. The SUR bistable may itself be bypassed by use of a keylock bypass switch HS! on the intermediate range (IR) nuclear instrument IG! drawer. The bypass function provided by the keylock bypass switch relies upon the integrity of the 120 VAC vital bus #1 EF! to maintain the SUR bistable relay energized.

Vital bus #1 (VB1) EF! is a 120 VAC system normally powered from

125 VDC Bus #1 EJ! via inverter #1 INVT!. A sensed undervoltage condition on VB1 (such as would be caused by a ground) initiates an automatic transfer of VB1 from inverter #1 to its alternate power source. The transfer is a "slow" transfer, which results in a momentary loss of power to VB1.

C. DESCRIPTION OF THE EVENT:

1. Event:

At 1314 on 10/17/91, during the performance of corrective maintenance on an alarm module TA! powere
from vital bus #1
(VB1), and with the AP4D relay in a failed (de-energized) condition, Unit 1 automatically tripped from 91% power on a spurious high startup rate (SUR) signal. The spurious signal occurred when a momentary power interruption to VB1 occurred during a transfer to its alternate power source. The VB1 transfer was initiated due to a momentary ground fault. As a taped alarm module power lead was being routed through an uninsulated grooming hole (a knockout hole used for wire routing) in the alarm module chassis, the lead arced apparently through the tape to the module chassis, causing the ground. The reactor protection system (RPS) and automatic control systems functioned as designed, and the plant was stabilized in Mode 3 at 1342.

An Auxiliary Feedwater (AFW) BA! actuation occurred due to the expected decrease in steam generator (SG) SG! levels following the trip. All AFW components responded in accordance with design. The AFW actuation was reset at 1401.

2. Inoperable Structures, Systems or Components that Contributed to the Event:

The AP4D relay had failed at 0913 on September 24, 1991. As a result, the high SUR protection circuit was no longer bypassed (and thus was "armed") during power operation. At 1025, the high SUR bistable was bypassed using the keylock bypass switch on each IR drawer. However, this action did not prevent the momentary interruption in power to VB1, with the prior failure of the AP4D relay, from causing a high SUR reactor trip.

Soon after failure of the AP4D relay, a preliminary work plan

was developed to replace the relay. However, the initial evaluation of the work plan identified that the actions necessary to replace the relay represented a significant trip hazard due to location of the relay and the potential impact of the maintenance on other plant equipment. As a result, replacement of the relay was delayed while further evaluation of the work plan could be pursued.

3. Sequence of Events:

DATE TIME ACTION

9/24 0913 The AP4D relay failed. At 1025, the high SUR trip was bypassed using the keylock bypass switch.

10/17 1314 Unit 1 tripped on high startup rate upon transfer of VB1 to its alternate source. An AFW actuation occurred due to the expected decrease in SG levels following the trip.

10/17 1342 Unit 1 stabilized in Mode 3.

10/17 1401 AFW actuation reset.

4. Method of Discovery:

Control room alarms and indications alerted the operators that the reactor trip had occurred.

5. Personnel Actions and Analysis of Actions:

The technician who performed the work on the alarm module utilized normally accepted methods for routing live power leads by applying insulating tape over the end of the lead. An examination of the affected lead directly following the trip showed that the lead was

properly centered in the tape, and that the lead was not previously exposed on any side. The technician used 3M Scotch Super 33+ electrical insulating tape, which is rated for 600 volts. Its use on circuits associated with 120 VAC (such as VB1) was therefore proper.

Control room operators responded properly to the reactor trip, implementing the Emergency Operating Instructions to stabilize the plant in Mode 3.

6. Safety System Responses:

The RPS and AFW systems functioned as designed.

D. CAUSE OF THE EVENT:

During the performance of corrective maintenance on an alarm module powered from VB1, the technician performing the work properly utilized approved practices to apply insulating tape over the module power lead and then route it through the grooming holes in the module chassis. As he pushed the lead through the uninsulated hole, it contacted the edge of the hole (not an unexpected occurrence), and arced (short circuited) apparently through the tape to the module chassis. This caused initiation of a transfer of VB1 to its alternate power source, resulting in a momentary loss of power to VB1. De-energization of VB1, with the AP4D relay in a failed condition, resulted in de-energization of the associated UVS relay, which in turn caused the reactor trip.

Examination of the circular wire lug on the power lead that grounded through its insulating tape revealed the presence of a small hole in the tape through which the arc had occurred. Specifically, the hole was at the center tip of the wire lug, over which the tape had been folded.

Laboratory analysis of the taped lead revealed mechanical damage on the front of the tape adjacent to the melted area (surrounding the hole where the arcing had occurred). The tape had apparently been penetrated or significantly thinned during handling. This is postulated to have occurred when the lead contacted a sharp edge of the grooming hole on the alarm module chassis when the lead was inserted through the hole. Testing on a segment of the tape from the lug revealed that the insulating capability of the tape material was maintained up to 4200 VAC in one area and 4700 VAC in a second area. This evidence supports the conclusion that the insulating tape on the power lead must have been stretched or damaged since the arcing occurred on a 120 VAC system.

E. CORRECTIVE ACTIONS:

The methodology used to route insulated live leads will be reviewed. Any methodology enhancements (e.g., use of double insulating tape or use of insulating rubber "boots") identified by this review will be implemented as appropriate.

This event will be incorporated into applicable technician continuing training programs.

F. SAFETY SIGNIFICANCE OF THE EVENT:

There is no safety significance to this event since the RPS and AFW system operated in accordance with design.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

The AP4D relay was manufactured by Westinghouse, model BFD53S, style 40E1914.

2. Previous LERs for Similar Events:

LER 90-014 (Docket No. 50-206) describes an event in which a lifted lead came in contact with grounded equipment, resulting in a short circuit and an automatic start of emergency diesel generator #2. Contact was made to the grounded equipment as a result of the insulating tape coming off of the lead during grooming. The corrective action included training of appropriate personnel which emphasized techniques for minimizing the potential for short circuits. That corrective action did not prevent this (LER 91-017) event since the tape used to cover the power lead was verified to have been properly applied.

LER 87-010 (Docket No. 50-362) describes an event in which, during the performance of a design change, a technician inadvertently contacted a lifted lead to a fuel handling isolation system (FHIS) radiation monitor chassis through a corner of the insulating tape (i.e., the lead was not centered in the tape), causing a ground and an automatic FHIS actuation. Corrective actions from that event included providing the following instructions to technicians involved in implementing design changes: (1) exercise care in securing live leads, and (2) use double insulating tape. Since the tape used to cover the power lead was verified to have been properly applied, this

indicates that proper care was exercised by the technician performing the work described in this (LER 91-017) event. Use of double insulating tape may have prevented this event; however, LER 87-010 was discussed only with those technicians

associated with implementing design changes (and not with technicians involved in routine maintenance). Since that event, SCE has implemented a review of reportable occurrences such that other organizations that may be affected by the occurrence are identified (and can implement appropriate corrective actions). This review may have precluded the occurrence being reported in this LER.

3. Failure of High SUR Block Relay (AP4D):

The relay was manufactured in 1965, and likely had been installed since initial plant operation. The failure of the relay involved a degradation of the coil insulation due to long term heating (the relay is normally energized during plant operation). Therefore, failure of the relay is considered an end-of-life failure.

Following the trip, the AP4D relay was replaced with an in-kind part. Also, the AP4B relay was inspected, with no problems being observed. The AP4B relay will be replaced during the next outage of sufficient duration with availability of a replacement relay. A reliability centered maintenance evaluation will be performed to determine appropriate preventive maintenance to be implemented on the AP4B and AP4D relays.

4. Trip Hazard Evaluation of the Failed AP4D Relay:

As previously discussed in Section C.2, an evaluation was performed following the failure of the AP4D relay on September 24. This evaluation identified that a reactor trip hazard existed due to the "arming" of the high SUR trip function. Interim compensatory actions for the failed relay included bypassing the high SUR trip relay with use of the installed key-lock bypass switch. The evaluation did not identify, however, that the relays associated with the bypass switch which effect the high SUR trip bypass are powered from VB1, as is the associated high SUR trip relay. (Therefore, an interruption in power to VB1 would result in a reactor trip

with the AP4D relay de-energized.)

If the impact of a momentary loss of power to VB1 were identified, it is possible that the work plan for the corrective maintenance on the alarm module powered from VB1 (see Section C.1) might have been further scrutinized. This, in turn, may have resulted in the work being deferred (since it was not necessary to be performed at the time) or additional precautions being required to prevent inadvertent grounding (such as double taping the module power leads). Appropriate personnel will review this event, with emphasis on this missed opportunity and the need to identify all potential trip hazards when evaluating the impact of a failed component.

ATTACHMENT 1 TO 9111250168 PAGE 1 OF 1

Southern California Edison Company

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November 18, 1991

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Docket No. 50-206
30-Day Report
Licensee Event Report No. 91-017
San Onofre Nuclear Generating Station, Unit 1

Pursuant to 10 CFR 50.73(d), this submittal provides the required 30-day written Licensee Event Report (LER) for an occurrence involving an automatic reactor trip. This occurrence had no effect on the health and safety of either plant personnel or the public.

If you require any additional information, please so advise.

Sincerely

Enclosure: LER No. 91-017

cc: C. W. Caldwell (USNRC Senior Resident Inspector, Units 1, 2 and 3)
J. B. Martin (Regional Administrator, USNRC Region V)
Institute of Nuclear Power Operations (INPO)

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